Sous Vide Cooker with Universal Controller

Written By: J N

TOOLS:

- HiTorque Mini Mill (1)
- Label maker (1)
- Phillips screwdriver (1)
- Side/End Mills (1)
- Soldering Iron and rosin core solder. (1)
- Uni-Bit (1)
- Wire stripper/crimper (1)
- hand-held electric drill (1)

PARTS:

- PID temperature controller JLD 612 (1)
- 25A solid-state relay (1)
- Thermocouple Type K (1)
- Power inlet with fuse and switch (1)
- 120V Outlets - Panel mount (2)
- Pair of banana jacks (1)
- Metal enclosure (1)
- Electric Kettle heating element (1)
  Comes with silicone gasket to seal out moisture
- Rubbermaid 3.5-gallon food storage container (1)
- Aquarium recirculation pump (1)

SUMMARY

The *sous vide* (pronounced "soo-veed") technique involves cooking food in vacuum-sealed pouches submerged in a water bath held at a precisely-controlled temperature.

This guide will go through the steps necessary to build your own sous vide cooker. What is

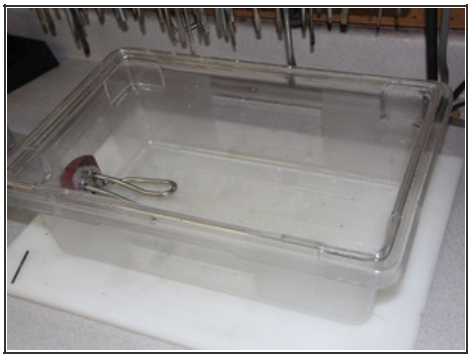
unique about this design is that the controller was built with more than just sous vide in mind. The controller is a general-purpose PID type controller but the external interfaces were partitioned so that other items can be controlled. The output of the PID controller runs through a high-power solid-state relay to a standard 120V outlet. A second 120V outlet is available for "continuous on" type of interfaces.

In the sous vide cooker the solid-state relay output switches a heating element on and off. The thermocouple input to the controller is through some banana jacks on the rear of the controller box.

Other features that make this controller unique are that an integrated power cord, fuse and lighted power switch are used, and all of this is mounted in an aluminum enclosure to give the project a professional look and feel.

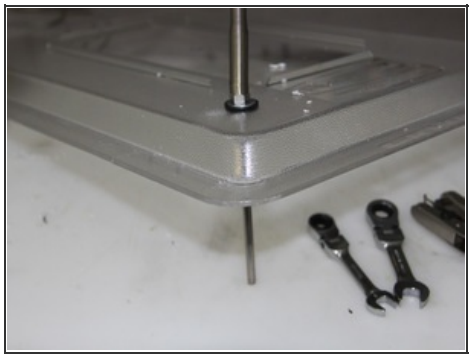
Step 1 — Sous Vide Cooker with Universal Controller





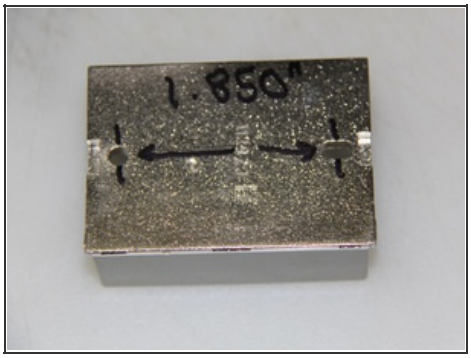
- A 3.5G Rubbermaid plastic food storage container was used. A hole was cut with a Dremel tool using a crosscut bit and cleaned up with a sanding drum. A water kettle heating element was then installed in this hole. The element was slightly offset to the side to make room for the water pump and thermocouple.
- The silicone grommet that comes with the kettle heating element is somewhat difficult to install. Do not size the hole too large as the grommet will fit in a hole approximately 1" in diameter. I used the inside diameter of the grommet as a guide for the hole size.
- Once the grommet is in place the two halves of the kettle heating elment go together. One advantage of using a kettle heating element is that the device has a high-temperature shutdown bimetalic switch built into it. If for some reason the water were to boil off the element would not be allowed to continue to heat and possibly melt the enclosure.

Step 2

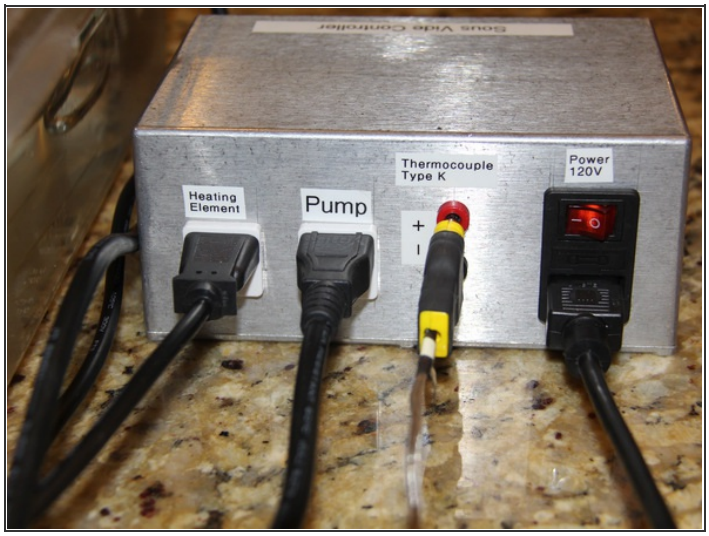

- The plastic food container lid was modified by installing the thermocouple probe as well as a grommet and the power cord for the recirculation pump.
- The thermocouple was installed with some rubber washers to eliminate condensation from potentially leaking at this point.
- The pump can be mounted on the side wall (preferred) or the bottom of the container.

Step 3



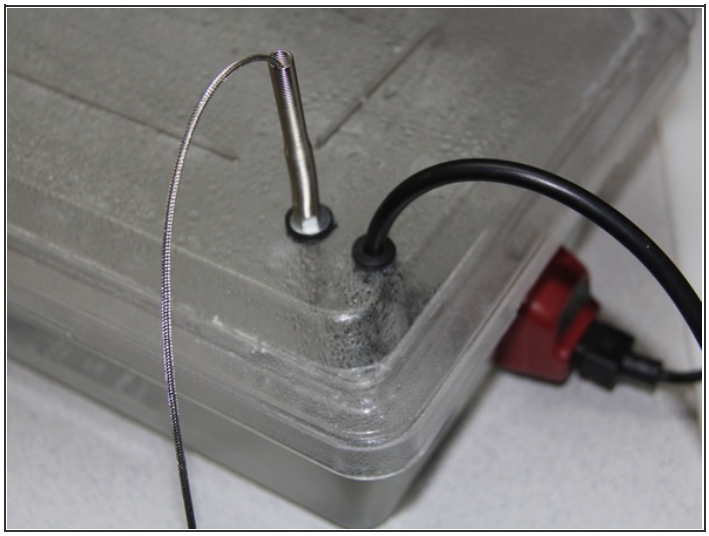

- Assembling the controller is not that difficult. All holes in the enclosure were marked and cut on a milling machine. The relay was mounted to the side wall near the power inlet. The metal enclosure is a good conductor for the heat and should alleviate any concerns over high heat.
- Power is routed in through the combined power inlet and fuse/switch. The hot lead is wired from the fuse terminal to the switch and then out to one of the outlets as well as to the PID controler and one side of the solid-state relay (SSR). The outlet of the SSR is wired to the second 120V outlet.
- All of the neutrals (lighted switch, PID, and 120V outlets) were tied together with a large wire nut.
- The ground was wired into the green ground wires for the 120V outputs as well as the case ground. All power cords used in this design are the three-prong type for safety and ease of use.
- Two holes spaced 0.75" apart were used to mount insulated banana jack sockets. The thermocouple was wired from the terminals directly into the PID controller.

Step 4



- The back of the controller is shown with the two 120V outlets (one PID-controlled), the two pins for the thermocouple, and finally the power switch input.
- The front of the unit contains only the PID controller. Labels were added to make the product look more professional.

Step 5



- Final assembly consists of connecting the pump and heating element to their respective positions on the controller as well as setting the target temperature and plugging in the thermocouple.
- The photo shows the cooking container with integral heating element, sensor, and the recirculation pump routing
- When not in use for sous vide the controller will see use as a charcoal grill temperature controller. A small 120V-powered fan is hooked to the PID outlet and new setpoints programmed. The flexibility of a system like this is appreciated if you understand the many possible uses of a PID controller.

The controller is assembled as a standalone unit. One of the two 120V outlets is controlled via the PID controller and solid-state relay. The second 120V outlet is switched with power button and used in this case for a recirculation pump.

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